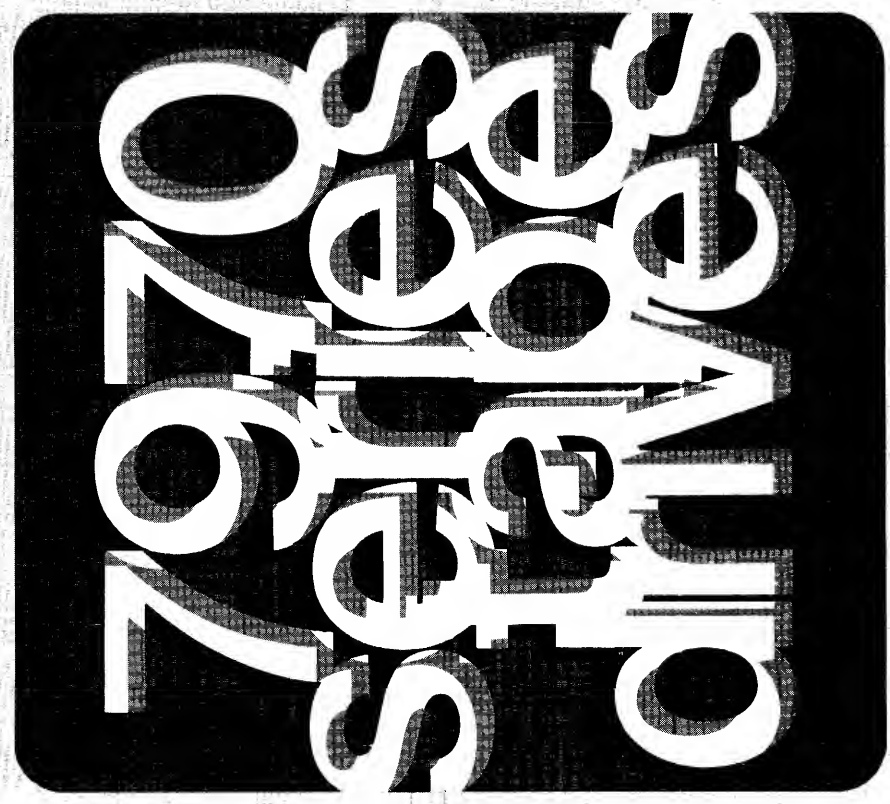
HEWLETT PACKARD

# 7970 SERIES

## MAGNETIC TAPE DRIVES




## OPERATOR'S MANUAL

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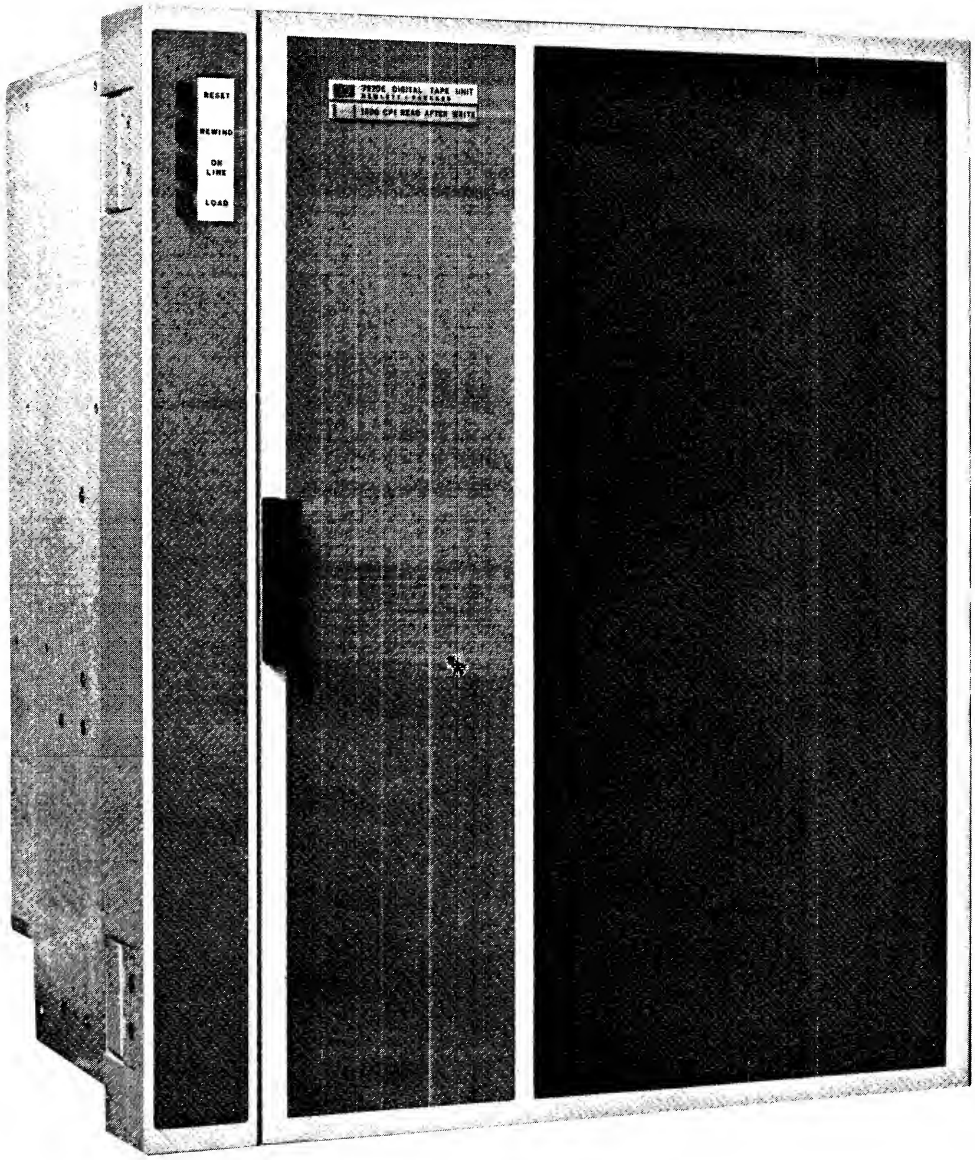
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# GENERAL INFORMATION

## INTRODUCTION

This is an operator's manual for digital magnetic tape units manufactured by the Hewlett-Packard Company. It is divided into two sections. First, General Information which describes the various configurations of tape units available from HP and provides complete specifications for the tape units. Second, Operation which gives specific instructions needed to operate the tape units.

## HEWLETT - PACKARD DIGITAL MAGNETIC TAPE UNITS

This manual is designed to cover more than just your tape unit. Hewlett-Packard manufactures many configurations of tape units and this manual is for operators of all configurations. To better understand the capabilities of your tape unit (or units) let's look at some of the variables that account for the different tape unit configurations.

**NRZI OR PE??** Your tape unit is one of two basic types which are distinguished by the technique used to record data on magnetic tape. These recording techniques are referred to as "Non-Return-to-Zero-Inverted" (NRZI) and "Phase Encoded" (PE). If you know what these terms mean, fine; if not, don't be concerned. The important point is that there is a difference and the two techniques are not interchangeable. If a tape is written in NRZI it must be read by NRZI tape units; likewise PE.

If your tape unit is a model 7970B/C, it is designed to write and/or read tapes using the NRZI techniques. If it is a model 7970E, it is designed to write and/or read using the PE technique and, on certain read only configurations, also read NRZI. As stated above, if the tape drive is set up for PE it can read only PE tapes; likewise for NRZI.

**NOTE:**

Model 7970C is a special configuration of the 7970B. See special modification notice accompanying this manual for details of changes. For all practical purposes, as far as you the operator are concerned, there is no difference.

**SEVEN TRACK OR NINE TRACK??** NRZI is written either seven- or nine-track, and PE is always nine-track. NRZI data, for the purpose of recording on magnetic tape, is coded in one of two ways. One requires seven bits per character; the other, nine bits per character. Both of these codings include one bit for parity (a method of error detection). It is apparent that data coded in seven-bit characters is written on tape in a seven-track format. Nine bits per character then requires a nine-track format.

**DENSITY??** To further complicate things, digital magnetic tapes are recorded at different densities, simply stated in terms of characters per inch (cpi) of tape. HP NRZI tape units

support densities of 200, 556, and 800 cpi for seven track and 800 cpi for nine track. Phase encoded tapes are always recorded at 1600 cpi.

**SPEED??** Both NRZI and PE tapes can be handled at a wide variety of speeds (45.0 - 10.0 inches per second). Standard HP tape units operate at speeds of 45.0, 37.5, 25.0, and 22.5 inches per second (ips).

**READ AND/OR WRITE??** Hewlett-Packard tape units can be configured to simply read prerecorded digital magnetic tapes or to both read and write tapes. These are referred to as read-only (RO) and read-after-write (RAW).

**STANDARD CONFIGURATIONS AND STANDARD OPTIONS.** We have covered most of the variables that apply to the HP tape units. Let's look now at the characteristics of the specific tape units manufactured by HP.

Table 1-1 lists the standard configurations of tape units manufactured by Hewlett-Packard. Note that this table shows both 7970B and 7970E units. From left to right, the first column of the table is MODEL-OPTION. Note that all units have an option number. We will refer to the option numbers in this column as standard options.

**Table 1-1, Configuration Guide, 7970B/7970E Magnetic Tape Units**

| | Density | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model-Option | 200 | 556 | 800 | 1600 | Master | Slave | 7Tr | 9Tr | NRZI | PE | RO | RAW |
| 7970B-127 | | | x | | NA | NA | | x | x | | | x |
| 7970B-136 | x | x | x | | NA | NA | x | | x | | | x |
| 7970E-150 | | | | x | | x | | x | | x | | x |
| 7970E-151 | | | | x | x | | | x | | x | | x |
| 7970E-152 | | | | x | | x | | x | | x | x | |
| 7970E-153 | | | | x | x | | | x | | x | x | |
| 7970E-162 | | | x | x | | x | | x | x | x | x | |
| 7970E-163 | | | x | x | x | | | x | x | x | x | |
| 7970E-164 | x | x | x | x | | x | x | x | x | x | x | |
| 7970E-165 | x | x | x | x | x | | x | x | x | x | x | |

NOTE:

RO = Read Only
RAW = Read After Write
All units are 45 ips speed unless speed option (001, 002, or 003) has been selected.

Model 7970C is a special configuration of the 7970B. See special modification notice accompanying this manual for details of changes. For all practical purposes, as far as you the operator are concerned, there is no difference.

The next group of columns specify recording DENSITY. Units that have more than one density listed have front-panel switches to select the desired density.

The next two columns are MASTER and SLAVE. This does not apply to 7970B units. The 7970E units can be either master or slave, the difference being that the master has a full set of electronics, the slave does not. One master unit can share its electronics with as many as three slave units.

The next two columns specify seven-track and nine-track. Two configurations of 7970E units will read either seven-track or nine-track tapes. Switches on the front panel allow this selection.

Next, NRZI and PE. Four 7970E read-only configurations can handle both. Again, front panel switches allow this selection.

The last two columns denote whether the unit is capable of reading and writing tapes (RAW) or reading only (RO).

**ELECTIVE OPTIONS.** In addition to the standard options, elective options may or may not be specified. The available elective options are as follows:

SPEED (001, 002, and 003). If a speed option is not specified, the unit is set for a speed of 45.0 ips. Specifying options 001, 002, or 003 results in speeds of 37.5, 25.0 or 22.5 ips respectively. (22.5 ips available on 7970E units only).

UNIT SELECT (007). The unit select option allows you, the operator, to change the tape unit number via the switches on the front panel. Tape units without the unit select option have unit select capability; however, unit numbers are assigned by wire jumpers internal to the tape unit.

PARITY SELECT (020). The parity select option allows odd or even parity to be selected from the front panel. This option applies to model 7970E, option 164 and 165 units only.

DUAL SPEED (021) The dual speed option is available only on 7970E units with standard option 162, 163, 164, and 165; then, only on units specifying a speed of 45 ips or 37.5 ips. On these units all NRZI operations run at a high speed (45.0 or 37.5 ips). When PE is selected, the speed is automatically cut in half.

DC POWER (048). This option allows the tape drive unit to operate from an input voltage of 42Vdc to 60Vdc, instead of the AC voltage normally required.

**SPECIALS.** The above information covers the standard configurations of HP digital magnetic tape units. There are a number of non-standard units referred to as "SPECIALS". If you have one of these units, you probably know more about it's intended use than I do. Operating these specials is really no different than the standard units, therefore, the operating section of this manual still applies.

**SPECIFICATIONS.** Table 1-2 provides a complete listing of the 7970B/7970E digital magnetic tape unit specifications.

**Table 1-2, Specifications, 7970B/7970E Magnetic Tape Unit**

Tape Speed
45.0 ips

Reel Diameter
Up to 10.5 inches
(26.7 cm)

Tape (computer grade)
Width: 0.5 inches (1.3 cm)
Thickness: 1.5 mils min

Tape Tension
0.240 kg, nominal (8.5 oz)

**Table 1-2 Continued**

Instantaneous Speed Variation
±3% (measured bit-to-bit)

Long-Term Speed Variation
±1%

Fast Forward/Rewind Speed
160 ips (4.06 mm/sec)

Fast Forward, Fast Reverse
Start/Stop Characteristics
Distance: 40 inches nominal
Start (25 ips)
69 inches nominal
Start (37.5 and 45 ips)
31 inches nominal
Stop (37.5 & 45 ips)
Time: 0.7 seconds, maximum

Start Stop Tape Travel
0.476±0.05 cm (.187±.020 in)

Reel Motor Braking
Dynamic

Magnetic Head Assembly
Standard: Seven or Nine-Track
erase, write, and read

Gap Scatter (Measured Optically)
Read Stack: 150 microinches, max
Write Stack: 150 microinches, max

Power Requirements
115 or 230 Vac
Switch Selectable
48 to 66 Hz, single phase
400 VA, maximum (on high line)

Write head to read head crosstalk
5% (of read signal)

Beginning-of-tape and end-of-tape
Reflective strip detection
photoelectric

Operating Environment
Ambient temperature: 0 to 55° C
(32 to 131° F)
Relative Humidity: 20 to 80%
(noncondensing)
Altitude: 3.048 km (10,000 ft)
Heat Dissipation 1400 BTU

Start/Stop Times
15 ms (at 25 ips)
10 ms (at 37.5 ips)
08 ms (at 45 ips)

Dimensions
Width: 48.3 cm (19 in)

Depth: 30.5 cm (12 in)
Overall Depth: 40.3 cm (16 in)

Weight
59.02 kg maximum (130 lb)

Transport Mounting
Vertical: Standard 48.3 cm
(19 in) Retma Rack

Skew
Static Skew: The per channel delayed one-shot deskewing technique is utilized in the write (forward) and read (forward and reverse) circuitry effectively eliminating static skew.

Dynamic
Skew: +−200 microinches (read-after-write) maximum.

Recording Mode
PE and NRZI

# OPERATION

## INTRODUCTION

This section provides the instructions and reference data required to operate HP digital magnetic tape units. For your reference all of the standard front panel controls and indicators are pictured in figure 2-1; their functions are described in table 2-1. The following outline is an overview of the details discussed in section two. This outline can be used as a check list once the operator is familiar with the operation of the unit.

1. Turn power ON. (Reset indicator lit.)
2. Load tape. (Upper hub for the supply reel.)
3. Depress Load Switch. (Indicator lights.)
   a. Write Enable as required.
   b. Unit Select as required.
   c. Density Select as required.
4. Depress On-Line. (Indicator lights.)
5. To unload tape.
   a. Press Reset.
   b. Press Rewind.
   c. At load point press Rewind again and the tape will wind completely onto the supply reel.

## MAGNETIC TAPE

Use computer grade tape; 0.5 inch wide, 1.5 mils thick, on reels 10.5 inches or less in diameter. Back coated tape should not be used.

**CARE.** Handle the tape and reel carefully: It is best to handle the reel by the hub flange to prevent warping the reel and possibly damaging the edges of the tape. Handling the tape itself should be kept to a minimum and then only handle that part of the tape required to load the tape unit.

Do not subject the tape to strong magnetic fields, excessive heat, or excessive cold. The dashboard of an auto on a warm day has been responsible for quite a bit of "irrecoverable data".

**STORAGE.** Tape should be stored in an environment that closely matches that of the computer system operating room temperature (approximately 15 to 25° C, 60 to 80° F, 60% relative humidity). If the storage environment is different than the operating environment, allow 12 to 24 hours for the tape to "adjust" to the operating environment before using it. Tape reels should be kept in their original containers and stored on edge, bookshelf style. If the tapes are laid flat, do not stack them.

**WRITE ENABLE RING.** New reels of tape from the supplier have a write enable ring (Figure 2-2) installed on the back of the reel. This ring, when in place, allows write operations (assuming the tape unit has write capabilities). To prevent accidental writing on tape during read-only operations, that is, to protect a tape file, remove the ring. The ring must be in place to allow recording.

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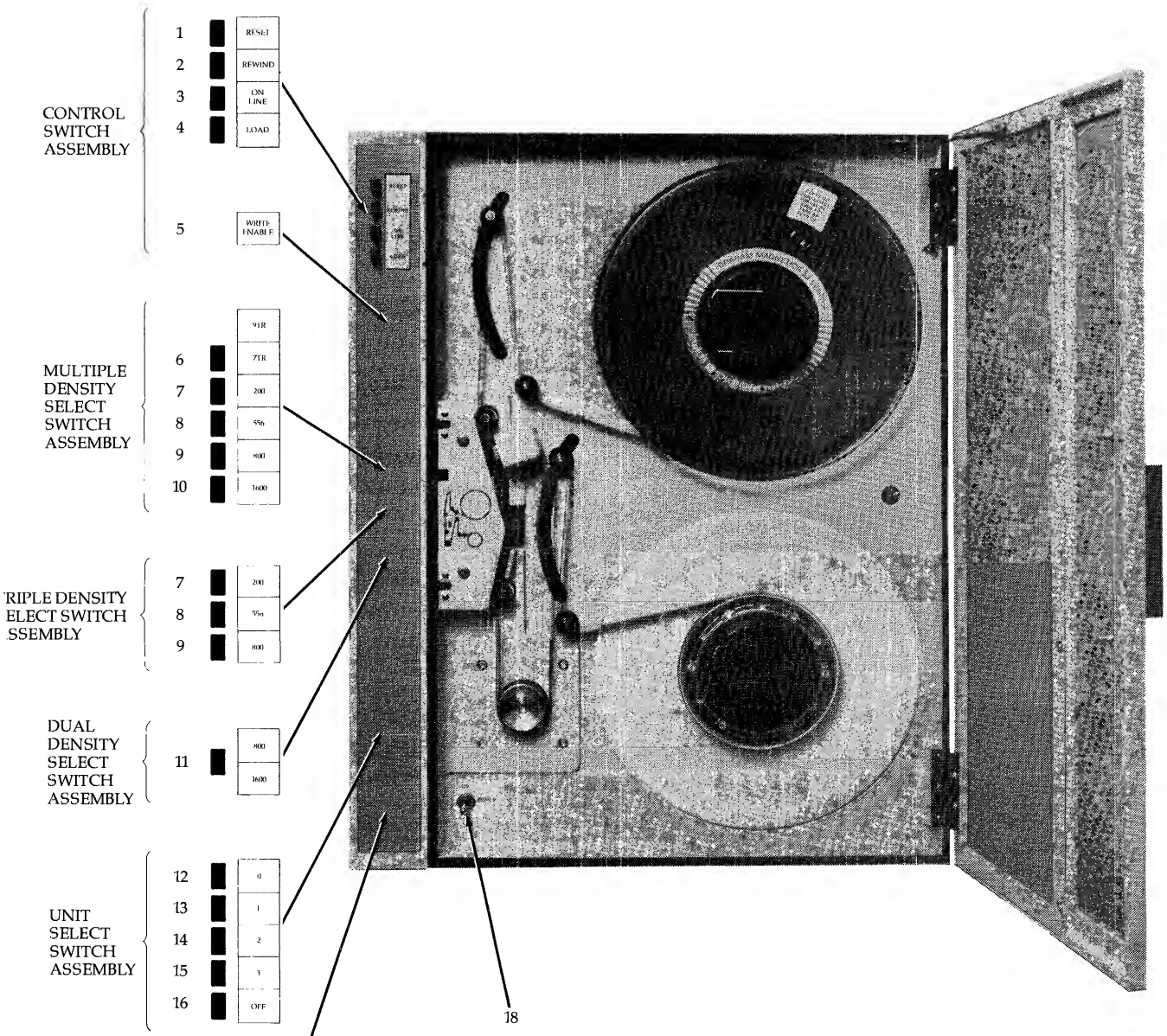


1. RESET CONTROL AND INDICATOR
2. REWIND CONTROL AND INDICATOR
3. ON LINE CONTROL AND INDICATOR
4. LOAD CONTROL AND INDICATOR
5. WRITE ENABLE INDICATOR
6. 7 TRACK/9 TRACK CONTROL AND INDICATOR
7. 200 CPI DENSITY CONTROL AND INDICATOR
8. 556 CPI DENSITY CONTROL AND INDICATOR
9. 800 CPI DENSITY CONTROL AND INDICATOR
10. 1600 CPI DENSITY CONTROL AND INDICATOR
11. 800 CPI/1600 CPI DENSITY CONTROL AND INDICATOR
12. UNIT 0 ADDRESS CONTROL AND INDICATOR
13. UNIT 1 ADDRESS CONTROL AND INDICATOR
14. UNIT 2 ADDRESS CONTROL AND INDICATOR
15. UNIT 3 ADDRESS CONTROL AND INDICATOR
16. UNIT ADDRESS OFF CONTROL AND INDICATOR
17. ODD/EVEN PARITY SELECT CONTROL AND INDICATOR
18. POWER SWITCH

**Figure 2-1, 7970 Magnetic Tape Unit**

**Table 2-1, Controls and Indicators**

| | |
|---|---|
| **POWER SWITCH** | This is an ON-OFF toggle switch that connects the tape unit to its external ac power source. |
| **SUPPLY HUB** | Supports and rotates the supply reel. |
| **TAKE UP HUB** | Supports and rotates the takeup reel. |
| **CAPSTAN** | Controls tape movement. |
| **LOCKING LEVERS** | Lock the reels on the hubs. |
| **TAPE GUIDES** | Maintain correct tape position as it passes over the head. |
| **THREADING DIAGRAM** | Indicates the correct tape path from reel to reel. |
| **READ HEAD** | Electromagnetically reads the data recorded on the tape as the tape passes over it. |
| **WRITE HEAD** | Electromagnetically records the data on the tape. |
| **LOAD SWITCH** | This momentary-pushbutton switch is pressed to tension tape and initiates Load Point Search. The indicator behind the switch lights to show that the tape is at Load Point (Beginning-Of-Tape, BOT). |
| **ON-LINE SWITCH** | This momentary-pushbutton switch is pressed to put the tape unit under system control ON-LINE. |
| **RESET SWITCH** | This momentary-pushbutton switch is pressed only when the controller is in a stop condition. (Stops tape travel, removes tape unit from controller control, and can be used by the operator to control Load Point Search if the tape threading operation allowed the BOT tab to be located past the head). |
| **REWIND SWITCH** | After the reset switch has been pressed to take the tape unit Off-Line, this momentary- pushbutton switch is pressed to rewind the tape. |
| **DENSITY SELECT (OPT)** | Selects the proper density to be read or written for a given operation. Also on NRZI/PE units selects mode, ie; 1600 = PE, and 800 or less = NRZI. |
| **UNIT SELECT SWITCH (OPT)** | Assigns a given unit an identification so the computer can select it and its information by demand and know which unit it (computer) is talking to. |
| **PARITY SELECT SWITCH (OPT)** | If available, allows the operator to select the proper parity for seven track depending on requirements. (Odd or Even). |

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**Figure 2-2, Write Enable Ring**

**BOT AND EOT TABS.** Beginning-of-Tape (BOT) and end-of-tape (EOT) light reflecting tabs are placed on the tape by the tape supplier. The tape unit finds the beginning and end of the tape by detecting light reflected by these tabs. If you have to replace these tabs due to a broken tape, figure 2-3 shows the placement of the tabs. The tabs (HP part number 9162-0062), have adhesive backs and are attached to the shiny side of the tape.

**NOTE:**

If the information on the tape is damaged or lost due to a break, the tape will probably be useless until it is rewritten.

## LOADING THE TAPE

Before putting the tape in the tape unit, take a close look at both the supply and takeup reels. They should be clean and not warped or broken. The supply reel goes on the top hub. Pull the hub locking lever outward, seat the supply reel firmly on the hub, and press the locking lever back into place. In the same manner, seat the takeup reel.

Unwind about four or five feet of tape from the supply reel and thread the tape unit as shown in figure 2-1. A tape threading diagram is also printed on the front of the tape unit. Manually wind two to three turns of tape on the takeup reel.

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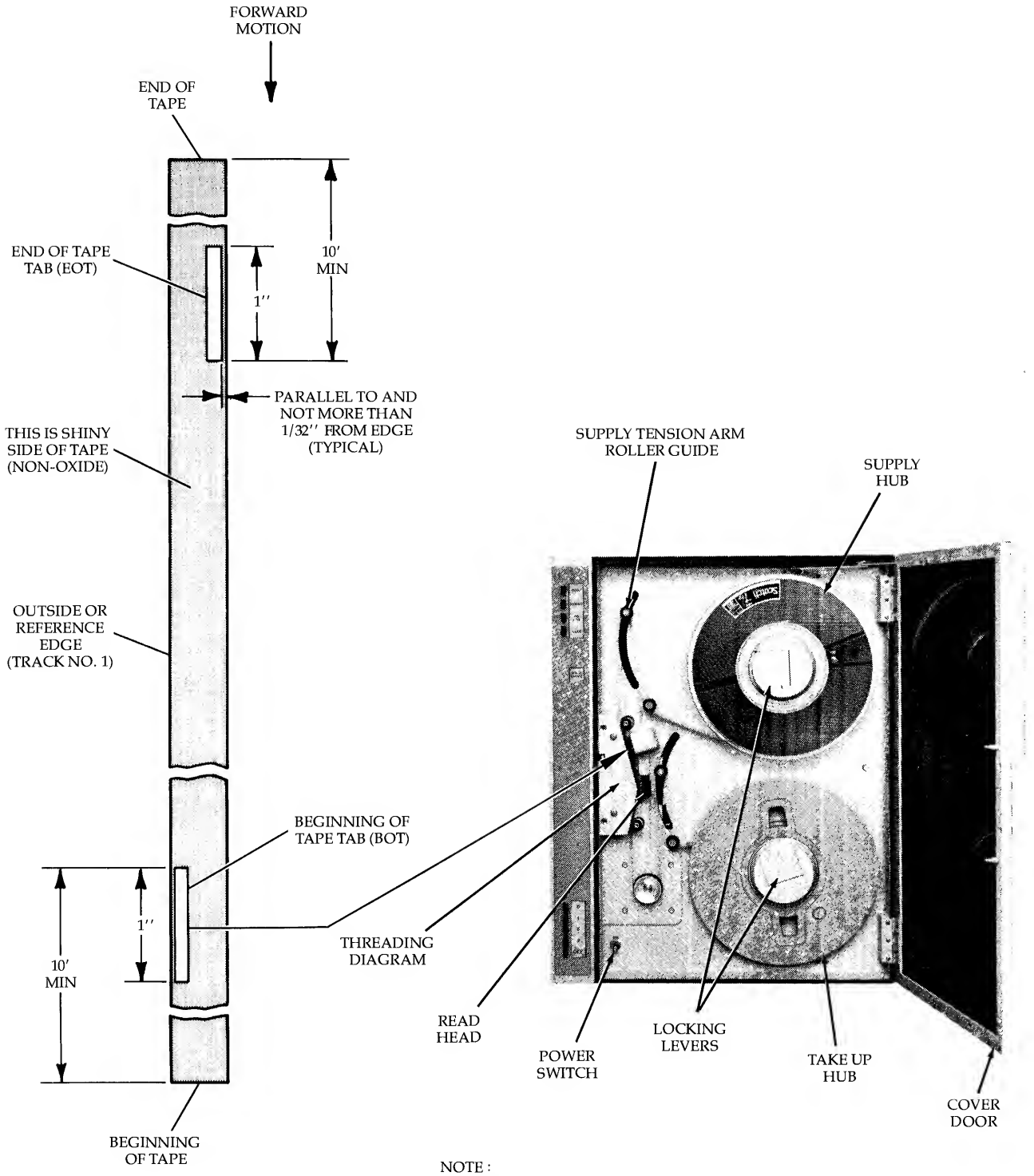


**Figure 2-3, Tape Threading**

7970-A-027

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This is a good point to stop and convince yourself that the tape is properly threaded. The tape should come off the bottom of the supply reel and go on the top of the take-up reel. On both reels the shiny side of the tape should be to the outside. Make sure that the tape is properly seated on all guide rollers and that there are no twists in the tape.

**NOTE:**

The BOT tab must be on the supply reel or between the supply reel and the photosense head. If it is at the photosense head or past it, the tape unit will not be able to locate the BOT tab during the following load point search operation.

If everything looks good at this point, set the POWER switch to ON.

**NOTE:**

Some tape units have interlocks so that they will not operate with the cover door open. Whether yours is interlocked or not, the cover door does keep dirt out of the tape unit and therefore, should be closed at this time.

If your unit does have the interlock, and the door is unlatched while the unit is on-line and running, it may be necessary to rewind the tape and start the job from the beginning. If the software (program) has allowed for this, it is only necessary to close the door and press On-Line.

Momentarily press and release the LOAD switch. The tape will execute a loadpoint search, moving the tape in the forward direction until the BOT tab is detected. Tape will stop at the loadpoint and the LOAD indicator will light.

## PLACING THE UNIT ON-LINE

The tape unit is now ready to be put under control of the computer (on-line). A quick check of the front panel controls and indicators is in order.

On the control switch assembly, only the LOAD and RESET indicators should be lit.

If your unit has the read-after-write capability, and if the supply reel write-enable ring is in place, the WRITE ENABLE indicator should be lit.

If your tape unit has DENSITY SELECT switches, the indicator for the "correct" density should be lit. The correct density is dictated, during a read operation, by the recording density of the tape to be read and, during a write operation, by the desired density of the tape to be written.

If your tape unit has the seven-track or nine-track selection, be sure the correct track number is illuminated.

If your tape unit has a UNIT SELECT switch, the correct number for this particular unit should be illuminated.

If your tape unit has PARITY SELECT switches, the indicator ODD or EVEN should be on depending which is selected in seven-track operation.

**NOTE:**

A logic relationship exists between the density control and parity switches. If you try to put in a wrong combination of track, density, and parity, the unit will automatically go to a valid combination. This may or may not be the one you need. Recheck for correct entries.

Press the ON-LINE pushbutton switch. Tape unit is now in a ready status and under computer control. The ON-LINE indicator should be lit.

Since the tape unit is now under computer control if, for instance, the REWIND switch is depressed there should be no response. However, if the RESET switch is pressed the ON-LINE indicator should extinguish and the unit should be returned to front panel control. At this time the RESET indicator should light.

NORMAL REWIND. Rewind can be initiated during any tape function by pressing the RESET pushbutton switch and then pressing the REWIND pushbutton switch.

## TAPE UNLOADING

To rewind the tape onto the supply reel when operation is complete, proceed as follows:

A. Press the RESET SWITCH, figure 2-1. The RESET indicator will light, and the ON-LINE indicator will go out.

B. Press the REWIND SWITCH. The REWIND indicator will light and rewind will be initiated.

To stop rewind, press the RESET SWITCH. To resume rewind, press the REWIND SWITCH.

C. Rewind will continue until the BOT reflective marker is sensed and passed. The tape unit then automatically goes into a BOT search, the tape stops at BOT, the REWIND indicator goes out, and the LOAD indicator lights.

D. Press the REWIND SWITCH again to rewind the remaining tape onto the supply reel. The REWIND indicator then goes out.

E. Open the cover door and remove the reel of tape from the supply hub. The RESET indicator remains on throughout the tape unloading procedure.

## RESTART AFTER POWER FAILURE

If a power failure occurs during a read or write operation the tape unit will be OFF-LINE. To resume the interrupted operation, proceed as follows:

A. Open cover door.

B. Verify that tape is on the guides.
(Any excess should be rewound on the supply reel).

C. Close cover door.

**NOTE:**

Steps D and E must be done quickly and in sequence to prevent loss of position on the tape if the unit starts a load point search.

D. Press LOAD.

E. Press RESET.

F. Press ON-LINE.

## OPERATOR MAINTENANCE

After every eight hours of operation, clean the SUPPLY and TAKE-UP TENSION ROLLERS, SUPPLY and TAKE-UP IDLER ROLLERS, TAPE GUIDES, CAPSTAN, PHOTOSENSE UNIT, TAPE CLEANER, and READ/WRITE/ERASE HEAD. Use cotton tipped applicators and lint-free wipers moistened with a cleaner such as one of the following:

Isopropyl alcohol
Head Cleaner (Hewlett-Packard No. 8500-0810)
Genesolve D (Allied Chemical)
Freon TF (Dupont)

Use the cleaner sparingly and avoid contaminating the bearings or any rubber surfaces. While cleaning, be alert for any mechanical malfunction or deterioration of parts which could cause damage to the tape.

Wipe away any accumulation of dust or dirt on the tape deck. Clean the Plexiglas cover door by brushing away any heavy residue with a soft-bristle brush and then cleaning gently with a wiper and commercial glass cleaner.

**NOTE:**

Table 2-2 lists the most common troubles that are encountered when operating a properly functioning tape unit, also the operator action to correct these troubles. If the tape unit does not respond to the corrective action or if other problems are noted, a tape unit malfunction is indicated and service personnel should be informed.

**Table 2-2, Trouble and Remedy Chart**

| Trouble | Probable Cause | Remedy |
|---|---|---|
| Tape unit ON-LINE indicator lights but controller does not show a START condition. | Loading instructions were not followed in sequence. | With the cover door closed, press the reset switch, load switch, and then the on-line switch. |
| | Controller job setup not complete or incorrect. | Refer to controller setup instructions. (For the controller itself.) |

**Table 2-2 Continued**

| Trouble | Probable Cause | Remedy |
|---|---|---|
| Tape fails to stop at the BOT reflective marker during load sequence. | Marker passed the photo sense unit during tape threading | Press the reset switch and then press the rewind switch. The tape will stop at BOT. |
| | Tape not threaded properly on rollers and guides | Refer to the TAPE LOADING section and repeat the procedure from the beginning. |
| | Photosense Head lamp not on. | Call your local HP service representative. |
| Power Failure. | Any power interruption that releases the tape tension. | Open the cover door and be sure the tape is threaded properly between all roller and guide flanges. Press the load switch to tension the tape and close the cover door. Press the rewind switch and start the job from the beginning. |

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